

CLAIMS

What is claimed is:

1. An air spring comprising a retainer, a base housing, an elastomeric sleeve secured to the retainer at a first end and secured to the base housing at a lower end to form a chamber, the elastomeric sleeve expanding from a retracted condition into an expanded condition, the air spring being characterized by:
a confined bladder within the chamber and defining a bladder chamber, the bladder chamber expanding from a collapsed condition to an inflated condition to displace at least a portion of an expanded volume within the sleeve chamber and adjust the spring rate of the air spring in the expanded sleeve condition.
2. An air spring in accordance with claim 1, wherein the air spring operates at a lower spring rate with the sleeve in the retracted position and a higher spring rate with the sleeve in the expanded position.
3. An air spring in accordance with claim 1, wherein the air spring has a lower relative height with the sleeve in the retracted condition and a higher relative height with the sleeve in the expanded condition.
4. An air spring in accordance with claim 1, wherein the bladder is substantially at 0 psig in the collapsed condition.
5. An air spring in accordance with claim 4, wherein the bladder in the inflated condition is overpressurized relative to the air pressure in the sleeve chamber.
6. An air spring in accordance with claim 1, wherein the bladder is in a non-contacting relationship with the sleeve in the inflated condition.
7. An air spring in accordance with claim 1, wherein the bladder has a pressure substantially higher than the surrounding chamber air pressure inside the elastomeric sleeve chamber.

8. An air spring in accordance with claim 1, wherein the bladder substantially conforms into a bellows shape in a collapsed condition.

9. An air spring in accordance with claim 1, wherein the bladder substantially comprises a rolling lobe sleeve configuration that lengthens and contracts in diameter when inflated and deflated, respectively.

10. An air spring having at least a relatively low and a relatively high spring height and an adjusted spring rate at each said height, the air spring comprising:

a retainer, a base housing, an elastomeric sleeve secured to the retainer at a first end and secured to the base housing at a lower end to form a chamber, the elastomeric sleeve expanding from a relatively collapsed configuration at the low air spring height into an expanded configuration at the high air spring height; and

a confined bladder within the chamber, the bladder being inflatable to displace at least a portion of an expanded volume within the sleeve chamber at the high air spring height to adjust the spring rate of the air spring at the high air spring height.

11. An air spring in accordance with claim 10, wherein the air spring having a relatively low spring rate at the low spring height and a relatively high spring rate at the high air spring height.

12. An air spring in accordance with claim 10, wherein the bladder is in a non-contacting relationship with the sleeve at the high and low air spring heights.

13. An air spring in accordance with claim 12 wherein the bladder and the sleeve have a lower end secured to a piston.

14. An air spring in accordance with claim 10, wherein the bladder is inflated to a substantially greater relative pressure than the sleeve chamber pressure at the high air spring height.

15. An air spring in accordance with claim 10, wherein the bladder substantially assumes a bellows shape at the low air spring height.

16. An air spring in accordance with claim 10, wherein the bladder is substantially a rolling lobe sleeve that lengthens and contracts in diameter when inflated and deflated, respectively.

17. An air spring in accordance with claim 10, wherein the spring rate of the air spring is adjusted by an adjustment to the volume of bladder inflation within the sleeve chamber and maintenance of an air pressure within the bladder substantially greater than the air pressure in the air spring chamber.

18. An air spring in accordance with claim 17, wherein the bladder is substantially at 0 psi air pressure in a collapsed condition and at a pressure ranging between 10 to 50 psi greater than the air pressure of the air spring chamber in an inflated condition.